DRAFT

TECHNICAL MEMORANDUM 9
ECOLOGICAL EVALUATION

SUMMARY
SITE INVESTIGATION AND REMEDIATION REPORT
AIRPORT/KLONDIKE AREA
AT
PRATT & WHITNEY
EPA ID No. CTD990672081

Prepared for:

PRATT & WHITNEY
400 Main Street
East Hartford, Connecticut 06108

Loureiro Engineering Associates, Inc.

July 06, 2000

US Environmental Protection Agency
JFK Federal Building (HBT)
1 Congress Street
Boston, MA 02114-2023

Attn.: Juan Perez

RE: Summary Investigation and Remediation Report - Airport/Klondike Area
Pratt & Whitney, East Hartford, Connecticut
LEA Comm. No. 88UT004

Dear Mr. Perez:

Attached please find four copies of additional information for the above-mentioned report for the Airport/Klondike Area at the Pratt & Whitney facility located at 400 Main Street in East Hartford, Connecticut. The information provided in this package includes the following:

- Technical Memorandum 9 Ecological Evaluation (Revised)

The information identified as "Revised" has been previously submitted for review and has been revised based on comments received as part of the review process.

If you have any questions or comments concerning the attached information, please contact me at 860-747-6181.

Sincerely,

LOUREIRO ENGINEERING ASSOCIATES, INC.

FOR

Thomas J. Salimeno, P.E.
Vice President

Attachments

pc: J. Tota, United Technologies Corporation
L. Hanna, HAI – Integrated Risk Management

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ACRONYMS

ACOE	Army Corps of Engineers
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DEP	State of Connecticut Department of Environmental Protection
EPA	Environmental Protection Agency
P&W	Pratt & Whitney
PCBs	Polychlorinated Biphenyls
RCRA	Resource Conservation and Recovery Act
TPH	Total Petroleum Hydrocarbons
USGS	United States Geologic Survey
VOCs	Volatile Organic Compounds

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EXECUTIVE SUMMARY

A habitat assessment was performed in conjunction with an evaluation of site investigation findings. The goal of the assessment was to ascertain potential ecological concerns at the Pratt & Whitney Airport/Klondike Area that might extend the current remediation considerations beyond human health concerns. The evaluation was performed by determining the habitat and ecological receptors located within the Airport/Klondike Area and by considering the contaminant classes, proximity of the contaminants to each habitat, and potential migration. Based on this evaluation, the ecological receptors with the greatest potential for exposure were determined for the Airport/Klondike Area.

The investigation found that the majority of the habitat is primarily in the early successional stages of forest development that followed the suspension of Pratt & Whitney operations in this area. Species diversity is related to the ecological context of the site, which is located within an urban area surrounded by residential neighborhoods and light industrial development. The nature and quantity of wildlife observed onsite is thus reflective of the high level of human activity surrounding the site and the lack of natural corridors through which wildlife can access these habitats. The types of wildlife observed during the onsite reconnaissance thereby correlates with those that can tolerate considerable human intrusion and/or habitat fragmentation, and are therefore fairly common and widely distributed in the eastern United States.

Species of greatest concern, such as Endangered, Threatened, or State Species of Concern, are generally less tolerant of human intrusion. The exceptions are grassland-nesting birds that require large expanses of maintained (periodically mowed) grasslands. Seven such species have been reported to occur near the site. No Endangered, Threatened, or State Species of Concern were observed during site reconnaissance. While potentially suitable habitat for grassland nesting birds is present on Site, this habitat is restricted to the sections of the airport that are not associated with site contamination. As observed, species representative of the Airport/Klondike terrestrial and wetland environs are beaver, deer, and fox. Aquatic community diversity is likely to be moderate to low due to the intermittent nature of most surface water flow (i.e. intermittent and low flow) and the high level of organic matter (i.e. leafy material) decaying on the stream bed.

Any potential future impacts to the aquatic habitat (e.g. via runoff or groundwater discharge) will be minimized by the current and future site remediation. Thus, from a consideration of exposure, potential food chain impacts are likely addressed by remedial goals protective of human

receptors. Consequently, direct exposure to site contaminants should be considered the principal exposure route to ecological receptors. Because the terrestrial species are unlikely to nest or reside long within the disturbed areas where the site contamination has been found, the terrestrial species passing through these areas are unlikely to require greater consideration than human receptors for whom remedial considerations are currently focused.

1. INTRODUCTION

Remediation efforts at the Pratt & Whitney (P&W) Main Street facility have been driven primarily by human health concerns because of the urban nature of the site surroundings and the current active operations on the western portion of the Main Street property. Figure 1 depicts the Main Street site location. The Main Street property consists of main factory complex and associated structures and operations. However, the eastern portion of the facility consists of a now inactive airport and former experimental and test facilities referred to as the Airport/Klondike Area collectively. These areas are shown in Figure 2. Consequently, a qualitative ecological assessment was undertaken to evaluate whether the determination of site remedial needs should be expanded from human health protective goals to include ecological concerns.

An evaluation of the potential ecological receptors at the Airport/Klondike Area was performed via a desktop analysis. Based on this analysis, focused field surveys were conducted. The primary objective of the field efforts was to serve as a field-supported characterization of ecological conditions at the site. On the basis of the review of existing ecological information and the focused field surveys, this report identifies and evaluates potential habitats and ecological receptors, as well as potential sources of exposure and ecological concerns that may result from site exposures. In part, this technical report provides a real-time assessment to support the conceptualization of potential ecological risks associated with the Airport/Klondike Area from which to consider remediation needs.

In general, the desk top analysis and focused field surveys reported here are an outgrowth of the developing ecological risk assessment process required under various state and federal regulatory mandates. Overall, focused field surveys are designed to support the ecological risk assessment process as outlined by the U.S. Environmental Protection Agency (EPA), including "Risk Assessment Guidance for Superfund: Volume II, Environmental Evaluation Manual" (EPA 1989); "Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference" (Warren-Hicks, Parkhurst, and Baker 1989); "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments" (EPA 1997); and "A Framework for Ecological Risk Assessment" (EPA 1992). The application of ecological assessment techniques has become an integral part of the regulatory processes under Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

Within these regulatory settings, a technical framework has been developed to evaluate habitats potentially at risk using an integrated approach that has been developed and built on a framework originally designed for hazard assessment (Dickson, Maki, and Cairns 1979; Bergman, Kimerle, and Maki 1986; Dickson, Maki and Brungs 1987; Warren-Hicks, Parkhurst, and Baker 1989; Suter 1993). Within a risk assessment setting, an integrated approach centers on biological and physiochemical data analyzed and interpreted within ecological contexts to evaluate risks (Pascoe and DalSoglio 1994; Pascoe, Blanchet, and Linder 1994; Linder, Hazelwood, and Palawski et al. 1994).

Simply stated, the elements within the assessment strategy consider the integration of biological (including toxicological), physical, and chemical (including contaminants) information within an ecological framework. In addition to risk-driven questions (for example, acute or chronic effects) related to chemicals released or presumably released from sites, the analysis of risks to biological resources and ecological systems also considers indirect effects associated with contaminant exposures. For example, confounding variables in analysis are often associated with non-contaminant effects such as physical alteration of habitat. Contaminant and non-contaminant stressors are equally regarded in this assessment strategy, especially when remediation, restoration, or land-use alternatives are considered within the context of ecological risk. In general, the focus on habitat viability, biological effects, chemical data (contaminant concentration and matrix contamination), toxicity data and ecological characterization information contributes to an ecological risk assessment of a site.

The following summary of the review of existing ecological assessment information and focused field surveys is intended to support problem formulation and the development of a technically sufficient conceptual site model for the Airport/Klondike Area. By contributing to the development of the conceptual site model by defining habitats, potential migration pathways, and representative ecological species, this report focuses the analysis of potential ecological concerns to determine whether past site activities have or could potentially result in impacts to the habitats. As such, this assessment also provides a means to determine whether remediation activities require incorporating ecological considerations that may not be addressed by utilizing cleanup goals protective of human health.

This report is developed by first presenting the site setting followed by a review of habitats and wildlife in the area. Within this context, the potential contaminant exposures to the various habitats are reviewed. The habitat assessment and potential exposure evaluation are integrated in

the final section in which the findings relative to remediation considerations targeted to the ecological community are discussed.

2. SITE SETTING AND LOCAL SURROUNDING ENVIRONMENT

The P&W facility is located at 400 Main Street (Main Street Facility) in the Town of East Hartford, Connecticut. The Main Street Facility covers 1,097 acres with over 6.5 million square feet of floor area for manufacturing, research, office space, and space for related activities and support services. The area surrounding the Main Street Facility is essentially an urban, residential area with light industry along Main Street. As shown in Figure 1, the Airport/Klondike Area is surrounded by the operating facilities of the Main Street facility to the west and the business/residential area surrounding the facility property along its remaining borders. Figure 1 is a reproduction of a topographic map of the Site prepared from portions of the Glastonbury, Hartford-North, Hartford-South, and Manchester United States Geologic Service (USGS) 7.5-minute topographic maps. The zoning designations shown in Figure 1 were obtained from the Town of East Hartford Department of Inspections and Permits. The residential zoning categories of R2, R3, R4, and R5 designate lots with single and multiple family housing occupying up to 25-35 percent of the property. The business zoning categories of B-1a, B-1 and B-2 designate buildings up to 7,500 square feet occupying 75 percent of the property. The business and residential nature of the properties along the facility border, as well as the active facility operations, are expected to heavily influence the species of animals likely to occur on the facility properties based on their adaptation to urban or suburban environments.

The focus of this assessment is the area known as the Airport/Klondike Area that lies to the east of the main complex of buildings (Figure 2). P&W facility operations have ceased in this area except for investigation and remediation activities. The Airport/Klondike Area covers approximately 630 acres and is made up of four study areas: the North and South Airport Areas, consisting of overgrown grasses surrounding inactive runways, and the North and South Klondike Areas, consisting of a variety of wetland, aquatic, and terrestrial habitats interspersed with paved roads and building foundations and/or rubble remains. The Klondike Area was formerly used for experimental test operations as well as ancillary support operations for the main complex.

Surface water classification of the Connecticut River in the area of the Main Street Facility is SC/SB denoting a surface water goal of SB, i.e., suitable to receive cooling water discharges and discharges from municipal and industrial wastewater treatment systems. Willow Brook and Pewterpot Brook, located on the facility property, have not been classified but Connecticut guidance indicate the classification would be class A, i.e., suitable for recreational use, fish and wildlife habitat, agricultural and industrial supply, and other legitimate uses including

navigation. The surface water and associated tributaries, including man-made drainage ditches, receive groundwater discharge. Groundwater flow is generally to the west towards the Connecticut River; however, local groundwater flow is likely influenced by man-made features and local topography as discussed in Technical Memorandum 2 *Water-level Measurements and Site-Survey Data*.

3. IDENTIFICATION OF HABITAT AND WILDLIFE

The primary sources of information incorporated into this assessment include a wetland delineation and qualitative assessment, synthesis of review of natural history and eco-regions within Connecticut, consultation with the Connecticut Soil Survey Project Office, Natural Diversity Data Base consultation, correspondence with regional ecologists and biologists, reviews of Audubon-reported sightings, and several reconnaissance-level site surveys. In particular, a site investigation to identify habitat types was conducted in December 1997 and included five radial plot vegetation surveys, vegetation transect surveys, and time avian surveys. As a result, this assessment provides a summary of potentially affected areas, and potentially affected aquatic and wildlife populations.

As summarized below, this ecological assessment consists of a desktop review of existing habitat and wildlife data, and a site inspection of the Airport/Klondike Area and surroundings to identify critical habitats. These critical habitats are to be used in Section 4 in the identification of potential habitat exposures that might be affected by chemicals associated with past operations at the site. The following summary presents the information as is relevant to the potential for threatened and endangered species to exist onsite and the primary site habitats.

3.1 Identification of Threatened or Endangered Species Potentially Present

The identification of any endangered or threatened species found on a site under evaluation is of critical importance to any future uses planned for a site and is relevant to determining potential impacts of site contaminants. To ascertain whether threatened and endangered species may be present at the Airport/Klondike Area, a site-specific database search was conducted in addition to a site reconnaissance to identify any species that might fall under these classifications. At the request of P&W, a review of the Natural Diversity Database maps and files was conducted by State of Connecticut Department of Environmental Protection's (DEP) Natural Resources Center in Hartford, Connecticut. According to the information present in the Natural Diversity Database, "there are no known extant populations of Federal or State Endangered, Threatened, or Special Concern Species that occur at this site." Additionally, no threatened or endangered species were identified during onsite reconnaissance performed on December 17 and 18, 1997 by the staff of Gradient Corporation, nor during the site visits on March 5, 1998 by Sciences International.

The Natural Diversity Database did identify several state listed grassland bird species whose habitat requirements are similar to those found onsite. This list was compared against the Connecticut Results for the 1997 North American Breeding Bird Survey compiled by the United States Geological Service. Of the species identified in the Natural Diversity Database only the following species were identified as having been counted in the State during the previous year's breeding season: Savannah sparrow (*Passerculus sandwichensis*); American kestrel *(Falco sparverius*); Eastern meadowlark (*Sturnella magna*). All three species are listed as State of Connecticut special concern species. None of these species were observed onsite during the site reconnaissance. A large expanse of old field habitat is present on Site around the airport, and one or more of these species could potentially find appropriate breeding or migratory habitat there; however, this habitat is restricted to the sections of the airport that are not associated with site contamination.

3.2 Identification of Wetland Habitats

State of Connecticut and Federal wetlands were identified and delineated by Soil Science and Environmental Services, Inc. for the Airport/Klondike Areas and were verified during the habitat assessment in December 1997. During the wetland delineation, vegetation was carefully examined and numerous soil test holes were dug.

The Federal wetlands were identified using a three-parameter approach that is outlined by the U.S. Army Corps of Engineers (ACOE, 1987). These three identifying parameters are wetland hydrology, hydrophytic vegetation, and hydric soils. Wetland hydrology is present when the portion of the ground containing most of the vegetation roots (generally the upper 12 inches) is inundated or saturated sufficiently long into the growing season (generally 2 weeks or more) to preclude dominance by upland plants. Hydrophytic vegetation is present when the dominant plants are wetland indicator species (i.e., obligate wetland plants, facultative wetland plants, or facultative plants) as published in the National List of Plant Species that Occur in Wetlands: Northeast (Reed, 1988). Hydric soils exhibit one or more indicators of reducing conditions, as indicated by soil matrix color and redoximorphic features. With some exceptions (e.g., disturbed areas), wetlands must meet all three parameters. The wetland boundary is drawn at the point where one or more parameters are not met. Wetland types were classified using the U.S. Fish and Wildlife Service designations as described in Cowardin et al. (1979).

The State of Connecticut wetlands were identified based solely on their soil types. Soil types considered as being representative of wetland areas are under the designations of poorly drained, very poorly drained, alluvial, or floodplain. While the Connecticut Soil Survey identified and

delineated five basic soil types within the Airport and Klondike, additionals soil types were identified during the field effort. The predominate glacial outwash soil map units identified on the property were the moderately well drained Ninigret fine sandy loam and the poorly drained Walpole fine sandy loam. Two other glacial outwash soils that were mapped on the property are the excessively drained Windsor loamy sand and the very poorly drained Scarboro loam. Floodplain soil map units identified on the property include the very poorly drained Saco silt loam and Alluvial land which includes a mixture of soil drainage classes and textures. Areas of disturbed soils which contain a wetland condition were identified as the poorly to very poorly drained Aquents, while well drained to moderately well drained disturbed soils were idenfified as Made land.

Seven wetland areas were identified under the Federal designation for wetland areas. These areas are identified in Drawing 1 (Habitat Types and Locations) as "Forested Wetland" (for example, FW-1), "Emergent Wetland" (for example, EW-1), or "Shrub/Scrub Wetland" (for example, SS-1). Areas of wetlands are also identified along the banks of streams and ponds. All Federally designated wetlands would also meet the criteria for jurisdiction by the State of Connecticut. Connecticut designates wetlands based solely on soil type. In general, the areas designated under the State of Connecticut delineation parameters are larger than those classified under Federal designation parameters.

Area 1 is located along the southern boundary of the Airport/Klondike Areas. Area 1 includes the habitat types denoted as P-1, SD-1 and SD-2. This wetland area encompasses both sides of Pewterpot Brook and its tributaries in the South Klondike Area in addition to the stream areas feeding into and leading from the pond in the South Airport Area. Pewterpot Brook is a shallow, slow moving, low-gradient stream with a measured flow of 1.0 foot per second (ft/sec) and a volume of 7.5 cubic feet per second (ft^3/sec) as measured during the December 1997 Gradient survey. Due to the nature of its low flow and volume, the substrate consists primarily of dead leaves and other organic matter with patches of bare sand. The wetland areas of Area 1 are bordered by a variety of habitat types that include mature forest, immature forest, and grasslands. The dominant vegetation in Area 1 consists of trees and saplings such as red maple (*Acer rubrum*), red oak (*Quercus rubra*), white oak (*Quercus alba*), and black gum (*Nyssa sylvatica*). The dominant understory vegetation includes highbush blueberry (*Vaccinium corymbosum*), sweet pepperbush (*Clethra alnifolia*), and northern arrowwood (*Viburnum recognitum*) and the dominant herbaceous layer includes wood reedgrass (*Cinna arundinacea*) and royal fern (*Osmunda regalis*).

Area 2 consists of several sections of deciduous forested wetland in the eastern portion of the Klondike Area, including the habitat types denoted Drawing 1 as FW-1 through FW-7. The surrounding area is made up of mature forest. The dominant vegetation in this wetland area consists of trees and saplings such as red maple (*Acer rubrum*), white oak (*Quercus alba*), and black gum (*Nyssa sylvatica*). The dominant understory layer consists of shrubs and herbaceous plants such as sweet pepperbush (*Clethra alnifolia*) and cinnamon fern (*Osmunda cinnamomea*).

Area 3 consists of a large contiguous shrub/scrub wetland area along with several ditches located in the central portion of the Klondike Area. Area 3 is depicted on Drawing 1 as habitat type SS-3. The ditches associated with this wetland area form part of the drainage area for Pewterpot Brook. The surrounding area consists of immature forest habitat. The dominant vegetation in this wetland area consists of small trees and shrubs such as red maple (*Acer rubrum*), sweet pepperbush (*Clethra alnifolia*), and highbush blueberry (*Vaccinium corymbosum*). The understory areas are dominated by cinnamon fern (*Osmunda cinnamomea*).

Area 4 is a relatively large shrub/sapling swamp located among immature forest in the North Klondike Area. Area 4 is denoted on Drawing 1 as habitat type SS-7. Portions of this wetland are believed to be anthropogenic in origin due to prominent berms surrounding certain areas of the wetland. The dominant tree and sapling vegetation in this area is made primarily of red maple (*Acer rubrum*). Dominant shrubs and herbaceous plants in this area include sweet pepperbush (*Clethra alnifolia*), highbush blueberry (*Vaccinium corymbosum*), cinnamon fern (*Osmunda cinnamomea*), sheep laurel (*Kalmia angustifolia*), and marsh fern (*Thelypteris thelypteroides*).

Area 5 consists of a deciduous wooded swamp located among immature forest in the North Klondike Area. Area 5 is denoted on Drawing 1 as habitat types EW-2 and SD-3. The dominant tree species in this area include red maple (*Acer rubrum*) and red oak (*Quercus rubra*). Dominant shrubs and herbaceous plants include sweet pepperbush (*Clethra alnifolia*), witch hazel (*Hamamelis virginiana*), highbush blueberry (*Vaccinium corymbosum*), winterberry (*Ilex verticillata*), cinnamon fern (*Osmunda cinnamomea*), and tree clubmoss (*Lycopodium obscurum*).

Area 6 consists of a wet meadow area located among immature forest in the North Klondike Area near its border with the North Airport Area. The habitat types depicted on Drawing 1 for this area include SS-1, SS-2, and SS-6. The dominant herbaceous species in this area is the grass, redtop panicum *(Panicum rigidulum)*.

Area 7 is a shrub swamp located along Willow Brook in the northwestern section of the Airport Area. Drawing 1 depicts Area 7 as habitat types EW-1 and the northern portion of SD-3. The section of the Airport Area surrounding the brook is primarily open grassland habitat. Willow Brook is a shallow, slow moving, low gradient stream with a measured flow of 0.25 ft/sec and a volume of 1.25 ft^3/sec as measured during the December 1997 Gradient survey. Due to the nature of its low flow, the substrate consists primarily of dead leaves and other organic matter. The dominant shrub vegetation in the area are alders (*Alnus serrulata*) and silky dogwoods (*Cornus amomum*). Dominant herbaceous vegetation in the area consists of sensitive ferns (*Onoclea sensibilis*), jewelweed (*Impatiens capensis*), and rough-stem goldenrod (*Solidago rugosa*).

During previous investigations of the wetland areas of the Airport/Klondike Area, no animal species were observed in the areas identified at that time to be wetlands.

3.3 Identification of Aquatic Habitats

Using aerial photographs and visual observations during onsite reconnaissance surveys, two general types of aquatic habitats were identified in the Airport/Klondike Area: ponds and streams/ditches.

A pond approximately 1.3 acres in size was identified in an isolated section of the southwestern part of the Airport Area. The pond is fed by flow from a concrete conduit on its northern shore and is drained by a small stream flowing over a man-made dam on its southwestern bank. This stream eventually empties into Pewterpot Brook although often there is not enough water entering the pond to produce the overflow necessary to support the stream. The concrete conduit feeding the pond runs under the Airport Area and drains portions of the North Klondike Area. The banks of this pond are relatively steep and are approximately 10 feet high, which is a reflection of its anthropic origin.

Emergent vegetation found along the edges of the pond includes speckled alder (*Alnus rugosa*) and silky dogwood (*Cornus amomum*) with the banks being populated by sedges (*Carex* spp.) and ferns (*Osmunda* spp.). Farther from the edge are sweet pepperbush (*Clethra alnifolia*), highbush blueberry (*Vaccinium corymbosum*), red maple (*Acer rubrum*), red oak (*Quercus rubra*), gray birch (*Betula populifolia*), and black cherry (*Prunus serotina).* The vertebrate and invertebrate inhabitants which might be present would be animals typical of disturbed areas that could survive a variety of water conditions created by fluctuations in the water level as is typical of a pond of this nature. During an onsite reconnaissance, mallards (*Anas platyrhynchos*) and

evidence of beaver *(Castor canadensis)* were observed. These species both tolerate the presence of humans and are not unusual in urban environments such as those found around the site.

Two major streams exist in the Airport/Klondike Area: Willow Brook and Pewterpot Brook. Willow Brook is located in the northwestern corner of the North Airport Area and flows in a west-southwesterly direction towards the Connecticut River. Pewterpot Brook is located along the southern boundary of the South Airport and South Klondike Areas and flows in a westerly direction towards the Connecticut River. Pewterpot Brook drains a large portion of the Klondike Area in addition to receiving water from tributaries that drain part of the surrounding neighborhood.

The streams are shallow and slow moving and therefore contain large amounts of decaying natural organic matter as substrate. Because of these characteristics, the water can be expected to have limited oxygen levels that would limit the species able to survive in the stream habitat. Vegetation along the streams typically consists of well-established trees such as red maple (*Acer rubrum*) and black gum (*Nyssa sylvatica*). During the onsite reconnaissance, mallards (*Anas platyrhynchos*) and evidence of beavers *(Castor canadensis)* were observed in the stream/ditch habitat areas.

In addition to the streams, three stream tributaries are present in the Airport/Klondike Area. These tributaries are more properly classified as ditches in that they were man-made or altered to control storm water runoff when the facility was active. The first two ditches run north-south along the Perimeter Road and east-west within the North Klondike area and both empty into Pewterpot Brook. The third ditch system is in the northwest corner and connects to Willow Brook. These ditches are generally slow-moving and/or stagnant and may not contain water throughout the year. The ditches along Perimeter Road and in the northeast corner of the site are adjacent to many of the inactive test areas and may receive storm water runoff from areas in which contaminated soils have been remediated.

Due to the anthropic origin of the ditches, the vegetation found along them are typically shrubby, pioneer species associated with areas of past disturbance such as speckled alder *(Alnus rugosa)*, silky dogwood (*Cornus amomum*) and staghorn sumac (*Rhus typhina*). During an onsite reconnaissance, mallards (*Anas platyrhynchos*) and evidence of beavers *(Castor canadensis)* were observed in the stream/ditch habitat areas.

3.4 Identification of Terrestrial Habitats

In addition to the wetland and aquatic habitats found in the Airport/Klondike Area, several different terrestrial habitats were identified during the review of aerial photographs and confirmed during site reconnaissance. These terrestrial habitats are characterized as open field habitat, immature forest, and mature forest that together occupy the large majority of the Airport/Klondike Area (approximately 541 acres).

The portion of the site that is covered by open-field habitat covers the majority of the western side of the site and is approximately 348 acres in area. This area was originally a maintained open field surrounding the runway's two airstrips. Since the closing of the runways, this area has progressed through early stages of succession resulting in a change from cultivated grass species to opportunistic and invasive plant species that are common in urban areas that are not maintained. This change is due to the less frequent maintenance of the original ground cover. Currently redtop grass *(Agrostis alba)* dominates the flora found in this open field habitat but invasive species such as evening primrose (*Oenothera biennis*), milkweed (*Asclepias syriaca*), Queen Anne's lace (*Daucus carota*), pokeweed (*Phytolacca americana*), switchgrass (*Panicum virgatum*), witch-grass (*Panicum capillare*), barnyard grass (*Echinochloa crusgalli*), English plantain (*Plantago lanceolata*), broom-sedge *(Andropogon virginicus*), mullen *(Verbascum thapsus*), and goldenrods (*Solidago* spp.) are moving into the area. Trees and shrubs indicative of early stages of succession are also found in this habitat. Examples of the early successional stage trees and shrubs found in this habitat include eastern red cedar (*Juniperus virginiana*), tree-of-heaven (*Ailanthus altissima*), black cherry (*Prunus serotina*), common raspberry (*Rubus idaeus*), and blackberry (*Rubus* spp.).

During the site reconnaissance, several species of animals were observed in the open field habitat. These species are common year-round residents and can be expected in this environmental setting surrounded by an urban/residential area. Observed animal species include the red tail hawk (*Buteo jamaicensis*), American crow (*Corvus brachyrhynchos*), song sparrow (*Melospiza melodia*), gray fox (*Urocyon cinereoargenteus*), white-tailed deer (*Odocoileus virginianus*), grey squirrel (*Sciurus carolinensis*), and eastern cottontail (*Sylvilagus floridanus*).

The immature forest habitat is the second largest habitat type found at the Airport/Klondike Area and covers approximately 134 acres. The large majority (approximately 116 acres) of the immature forest habitat type is found in the northeastern corner of the Klondike Area with two smaller areas (11 acres and 7 acres) found in the mature forest in the southeast portion of the South Klondike Area and along the southern border of the South Airport Area, respectively.

This immature forest habitat is a result of succession in areas that have been cleared or developed in the past and is the primary area in which historical experimental testing operations or ancillary support activities were located.

Tree species observed in immature forest habitat include species typically found in early successional forests such as birches (*Belula* spp.), sassafras (*Sassafras albidum*), and red maple (*Acer rubrum*). Other plants identified in this habitat type include highbush blueberry (*Vaccinium corymbosum*), sweet pepperbush (*Clethra alnifolia*), tree clubmoss (*Lycopodium obscurum*), cinnamon fern (*Osmunda cinnamomea*), and bracken fern (*Pteridium aquilinum*). A variety of animal species could potentially be found in the immature forest habitat including reptiles, amphibians, birds, and mammals. Birds that were observed during site reconnaissance include the red tail hawk (*Buteo jamaicensis*), American crow *(Corvus brachyrhynchos*), downy woodpecker (*Picoides pubescens*), northern junco (*Junco hyemalis*), black-capped chickadee (*Parus atricapillus*), and the song sparrow (*Melospiza melodia)* that are not uncommon in residential forested areas. Mammal species observed onsite include those that are traditionally tolerant of some human development such as gray fox (*Urocyon cinereoargenteus*), white-tailed deer (*Odocoileus virginianus*), grey squirrel (*Sciurus carolinensis*), and eastern cottontail (*Sylvilagus floridanus*). Coyote sightings have also been reported by on-site workers. These sightings are not unexpected due to increasing populations of this highly adaptive species.

A subset of the immature forested habitat, and to some degree the open-field habitat is the terrestrial habitats composed of clearings and areas of development that occurred when the facility was operating. The open clearings are highly disturbed areas and are composed primarily of exposed soils with some light grasses. These areas are in the initial successional stage and provide little in the way of wildlife cover or nourishment. In the Airport/Klondike Area there are four areas of open clearings that occupy a total of approximately 4 acres. In the southwest corner of the site there are approximately 19 acres of light development. This area is composed of roads and parking lots used to house truck trailers and provide no appreciable wildlife habitat cover or nourishment. Both of these areas are undergoing active investigation and remediation.

In addition to the open field and immature forest habitat, a mature forest habitat also exists in the Klondike Area. The mature forest habitat is a result of the lack of disturbance or development in the area as it has been relatively undisturbed by facility operations. The mature forest habitat covers approximately 60 acres and is located in a continuous segment in the southeastern portion of the South Klondike Area. The dominant vegetation found in this area, as is typical of late

successional stages in southern New England, are trees with a few shrubs or herbaceous species present. Dominant tree species observed in this habitat area are typical forest trees found in Connecticut such as red maple (*Acer rubrum*) and eastern white pine (*Pinus strobus*) with lesser amounts of American beech *(Fagus gradifolia*), black cherry (*Prunus serotina*), white oak (*Quercus alba*), and pin oak (*Quercus palustris*). Herbaceous species in this habitat include black huckleberry (*Gaylussacia baccata*), sweet pepperbush (*Clethra alnifolia*), and tree clubmoss (*Lycopodium obscurum*). Due to the close proximity of the mature forest habitat to the immature forest habitat combined with the similarity of the two habitats, the faunal species that were observed in the mature forest habitat were the same as those observed in the immature forest habitats. These species are well adapted to the presence of humans and are not uncommon in urban areas.

4. POTENTIAL MIGRATION ROUTES AND EXPOSURES

The P&W operations in the Airport/Klondike Area consisted primarily of airport operations and experimental testing of airplane engines. The classes of chemicals that have been detected in various media during the site investigation are volatile organics compounds (VOCs) in site soils and surface and groundwater, total petroleum hydrocarbons (TPH) in soil and groundwater, and inorganics and polychlorinated biphenyls (PCBs) in soil and sediments. These chemicals were principally detected in areas that are associated with historical light industrial use and are currently the focus of remediation activities at the site.

The principal routes of potential contaminant migration from the site are via storm water runoff, groundwater migration, and surface water discharge (including groundwater discharge into surface water). However, since groundwater contamination is currently restricted within the site boundary, the principal route for potential offsite migration is via surface water that receives groundwater discharges. While the surface water from the site ultimately discharges into the Connecticut River, offsite migration has not been observed (See Technical Memorandum 6 *Surface Water and Sediment Sampling*. Thus, exposures are limited to onsite habitats. The potential exposures most likely to occur are those through the direct exposure of terrestrial species to surficial soils impacted by historical operations and the aquatic community exposed to surface waters and sediment. The contaminants present in the soil are currently being addressed and remediated through soil remediation actions that should also eliminate future impact to surface water.

Based on this information, it is concluded that, with respect to habitat exposures, the potential ecological exposures are considered to be contained onsite and are limited to the aquatic habitats adjacent to and within the developed areas in the Klondike Area's immature forest habitat. Within the aquatic community, the inorganics are likely to represent a more significant ecological concern than the volatile organics if present at levels of concern for the resident aquatic species. However, the diversity of the community is likely limited by the intermittent flow of water and the decay of natural organic matter within the stream. Within the terrestrial community, the surficial soil exposures would represent the most significant potential exposure media. The terrestrial species are, however, unlikely to nest or reside long within the disturbed areas where surficial soil contamination has been found due to the disturbed nature of these areas.

5. SUMMARY COMMENTS AND CONCLUSIONS

The objective of this assessment was to determine the habitat and potential ecological receptors which may be impacted by the past operations of the facility as well as concerns regarding future use and site development. The assessment identified the basic environmental characteristics of the site through the identification of habitat types along with the corresponding flora and fauna found in each of these habitats. This was accomplished by compiling data from the following sources:

- Endangered, Threatened, and Special Concern Species database searches;
- Species sightings database searches;
- Aerial photograph interpretation;
- Connecticut Soil Survey Project Office Consultation; and
- Onsite reconnaissance.

There are three general classes of ecological communities/habitats that occur onsite: wetland, aquatic, and terrestrial. The wetland habitats were characterized as emergent, shrub/scrub, or forested wetlands. Emergent wetlands make up approximately 1.1 percent of the total area, while shrub/scrub and forested wetlands make up 2.2 percent and 1.0 percent of the total area, respectively.

The aquatic habitats that occur onsite are either ponds or streams/ditches. The pond makes up approximately 0.2 percent of the total area of the Airport/Klondike Area. Streams and ditches for management of storm water runoff make up approximately 0.7 percent of the total area. The streams and ditches are potential migration routes of contaminants offsite. However, the site investigation does not indicate any offsite migration. Onsite concerns are being addressed through soil remediation.

The terrestrial habitats that occur onsite are open fields, immature forests, or mature forests. Open field habitat makes up approximately 59 percent of the total area of the Airport/Klondike Area. Immature and mature forests make up approximately 22 percent and 10 percent of the total area, respectively. These areas are relatively uncontaminated. Adjacent to the immature forest and across from the airport runways are open clearing areas which encompass

approximately 0.6 percent of the total area of the Airport/Klondike Area and areas with historical development which make up approximately 3.2 percent of the total area. These clearings and areas of development are the areas of principal concern for site investigation and remediation activities. Although these habitats are generally disturbed due to current and historical human activities, chemical stressor impacts are not apparent in these open and developed areas.

The Airport/Klondike Area is therefore composed of wetland, aquatic, and terrestrial habitats that can support a moderately diverse wildlife community that includes the avian and mammalian species listed in Tables 1 and 2 that were recorded during site reconnaissance events. The diversity of species is however related to the ecological context of the site; located within an urban area surrounded by residential neighborhoods and light industrial development. Species requiring very large home ranges and/or isolation from human activity would be excluded due to the surrounding development and lack of natural corridors to similar habitats. The species observed were predominantly those common year-round residents that tolerate human development and are fairly common and widely distributed in the eastern United States.

No species of special concern as defined by the State of Connecticut are known to use the site, and none were observed during site reconnaissance. This was expected since the reconnaissance was performed in the winter. Potentially suitable habitat for protected grassland birds is present on site. However, these species are unlikely to use the contaminated portions of the site with any frequency. As observed, species representative of the Airport/Klondike terrestrial environs are beaver, deer, and fox. Aquatic community diversity is most likely moderate to low due to the nature of the surface water flow, i.e. predominantly intermittent, and the high level of organic matter, i.e. leafy material, decaying on the streambed.

In addition, any potential future impacts to the aquatic habitat (e. g. via runoff or groundwater discharge) have been minimized by the current and future site remediation. Thus, from a consideration of exposure, potential food chain impacts are likely addressed by remediation goals protective of human receptors. Consequently, direct exposure to site contaminants should be considered the principal exposure route to ecological receptors. Because the terrestrial species are unlikely to nest or reside for an extended period within the disturbed areas where the site contamination has been found, the terrestrial species passing through these areas are unlikely to require greater consideration than human receptors for whom remediation considerations are currently focused.

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TABLES

Table 1

Animal Species Observed at the Airport/Klondike Areas

Animal Species	Aquatic		Terrestrial		
	Pond	Stream/Ditch	Open Field	Immature Forest	Mature Forest
Mallard (*Anas platyrhynchos*)	✓	✓	-	-	-
Red Tail Hawk (*Buteo jamaicensis*)	-	-	✓	✓	✓
American Crow (*Corvus brachrhynchos*)	-	-	✓	✓	✓
Northern Junco (*Junco hyemalis*)	-	-	-	✓	✓
Song Sparrow (*Melospiza melodis*)	-	-	✓	✓	✓
Black-capped Chickadee (*Parus atricapillus*)	-	-	-	✓	✓
Downy Woodpecker (*Picoides pubescens*)	-	-	-	✓	✓
Beaver (*Castor canadensis*)	✓	✓	-	-	-
White-tailed Deer (*Odocoileus virginianus*)	-	-	✓	✓	✓
Gray Squirrel (*Sciurus carolinensis*)	-	-	✓	✓	✓
Eastern Cottontail (*Sylvilagus floridanus*)	-	-	✓	✓	✓
Gray Fox (*Urocyon cinereoargenteus*)	-	-	✓	✓	✓

Table 2

Common Vegetation Observed at the Airport/Klondike

	Stream/Ditch Habitat	Wetland Habitat	Open Field Habitat	Immature Forest Habitat	Mature Forest Habitat
Acer rubrum (red maple)	✓	✓	✓	✓	✓
Agrostis alba (redtop)			✓		
Ailanthus altissima (tree-of-heaven)	✓		✓		
Alnus rugosa (speckled alder)	✓				
Andropogon virginicus (broom sedge)			✓		
Asclepias syriaca (common milkweed)			✓		
Berberis thunbergii (Japanese barberry)	✓				
Carex pensylvanica (Pennsylvania sedge)					✓
Cinna arundinacea (wood reedgrass)		✓			
Cinna latifolia (wood reed)				✓	
Clethra alnifolia (sweet pepperbush)		✓		✓	✓
Cornus amomum (silky dogwood)	✓				
Daucus carota (Queen Anne's lace)			✓		
Fagus grandifolia (American beech)					✓
Gaylussacia baccata (black huckleberry)					✓
Hamamelis virginiana (witch hazel)		✓			
Ilex verticillata (winterberry)	✓	✓			
Juniperus virginiana (eastern red cedar)	✓		✓		
Kalmia angustifolia (sheep laurel)		✓			✓
Lycopodium obscurum (tree clubmoss)		✓		✓	✓
Myrica pensylvanica (northern bayberry)	✓		✓		✓
Nyssa sylvatica (black gum)	✓	✓			
Oenothera biennis (common evening primrose)			✓		
Onoclea sensibilis (sensitive fern)			✓		
Osmunda cinnamomea (cinnamon fern)	✓	✓		✓	✓
Osmunda regalis (royal fern)		✓			

	Stream/Ditch Habitat	Wetland Habitat	Open Field Habitat	Immature Forest Habitat	Mature Forest Habitat
Panicum capillare (witch-grass)			✓		
Panicum rigidulum (redtop panicum)		✓			
Panicum virgatum (switchgrass)			✓		
Phytolacca americana (pokeweed)	✓		✓		
Pinus strobus (white pine)					✓
Plantago lanceolata (English plantain)			✓		
Polygonum cuspidatum (Japanese knotwood)	✓				
Populus tremuloides (quaking aspen)	✓				
Prunus serotina (wild black cherry)	✓		✓	✓	✓
Pteridium aquilinum (bracken fern)				✓	✓
Quercus alba (white oak)		✓			✓
Quercus palustris (pin oak)	✓				✓
Quercus rubra (red oak)		✓			
Quercus velutina (black oak)			✓		
Rhododendron viscosum (swamp azalea)	✓				
Rhus typhina (staghorn sumac)	✓				
Rosa multiflora (multiflora rose)	✓				
Rubus idaeus (common red raspberry)	✓		✓		
Rubus spp. (blackberry)	✓		✓		
Sassafras albidum (sassafras)				✓	
Schizachyrium scoparium (little bluestem)		✓			
Smilax glauca (catbrier)	✓				✓
Solidago sp. (goldenrod)			✓	✓	
Solidago canadensis (Canadian goldenrod)					✓
Thelypteris thelypteroides (marsh fern)		✓			
Toxicodendrum radicans (poison ivy)	✓				✓
Vaccinium corymbosum (highbush blueberry)		✓		✓	
Viburnum recognitum (northern arrowwood)		✓			✓
Vitis labrusca (summer fox grape)	✓				✓

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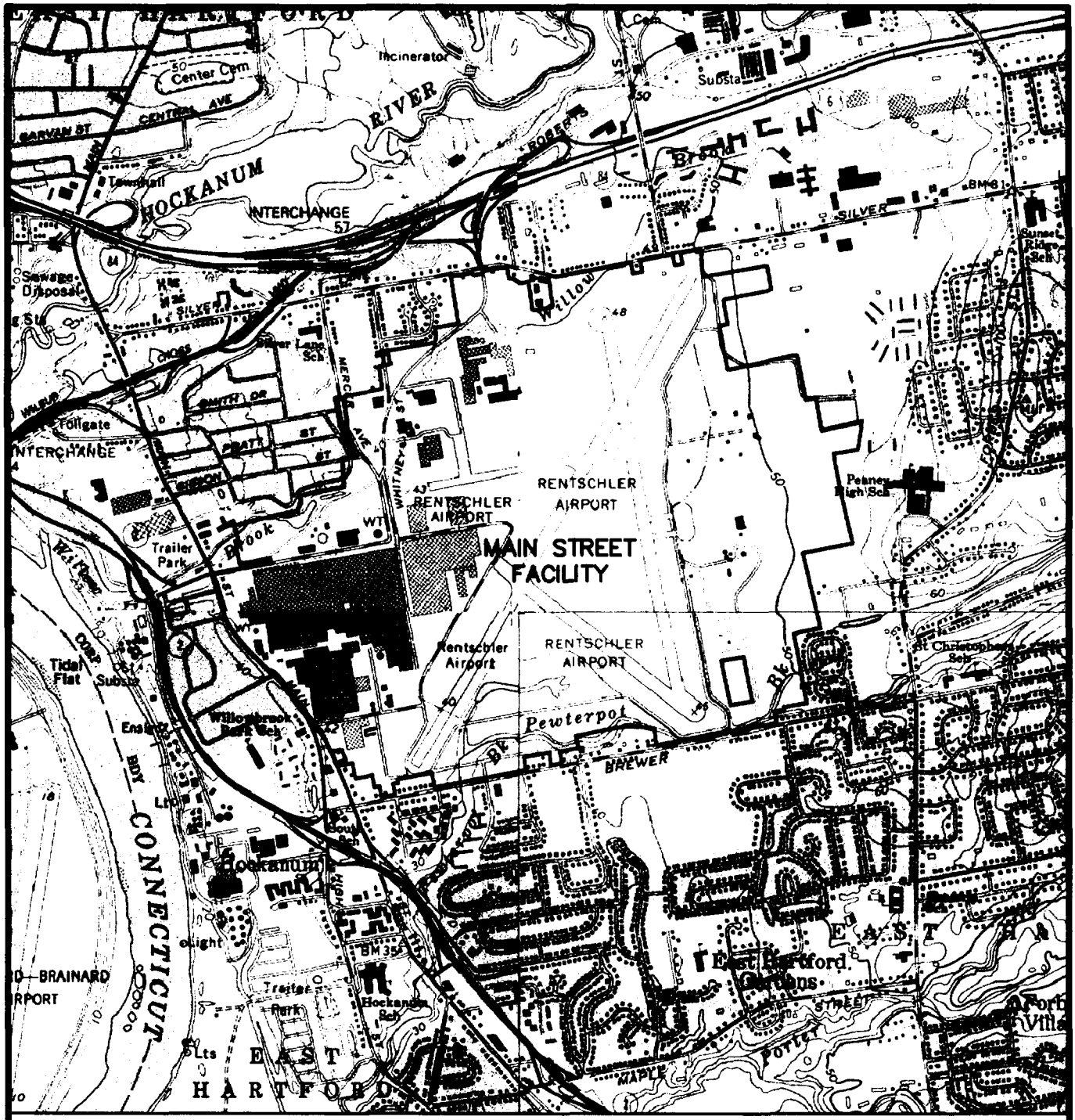
FIGURES



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MAP REFERENCE:
USGS 7.5 MINUTE SERIES QUADRANGLES FOR HARTFORD NORTH, HARTFORD SOUTH, GLASTONBURY, AND MANCHESTER CONN., DATED 1964 & 1963 AND REVISED 1992.

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SCALE IN FEET

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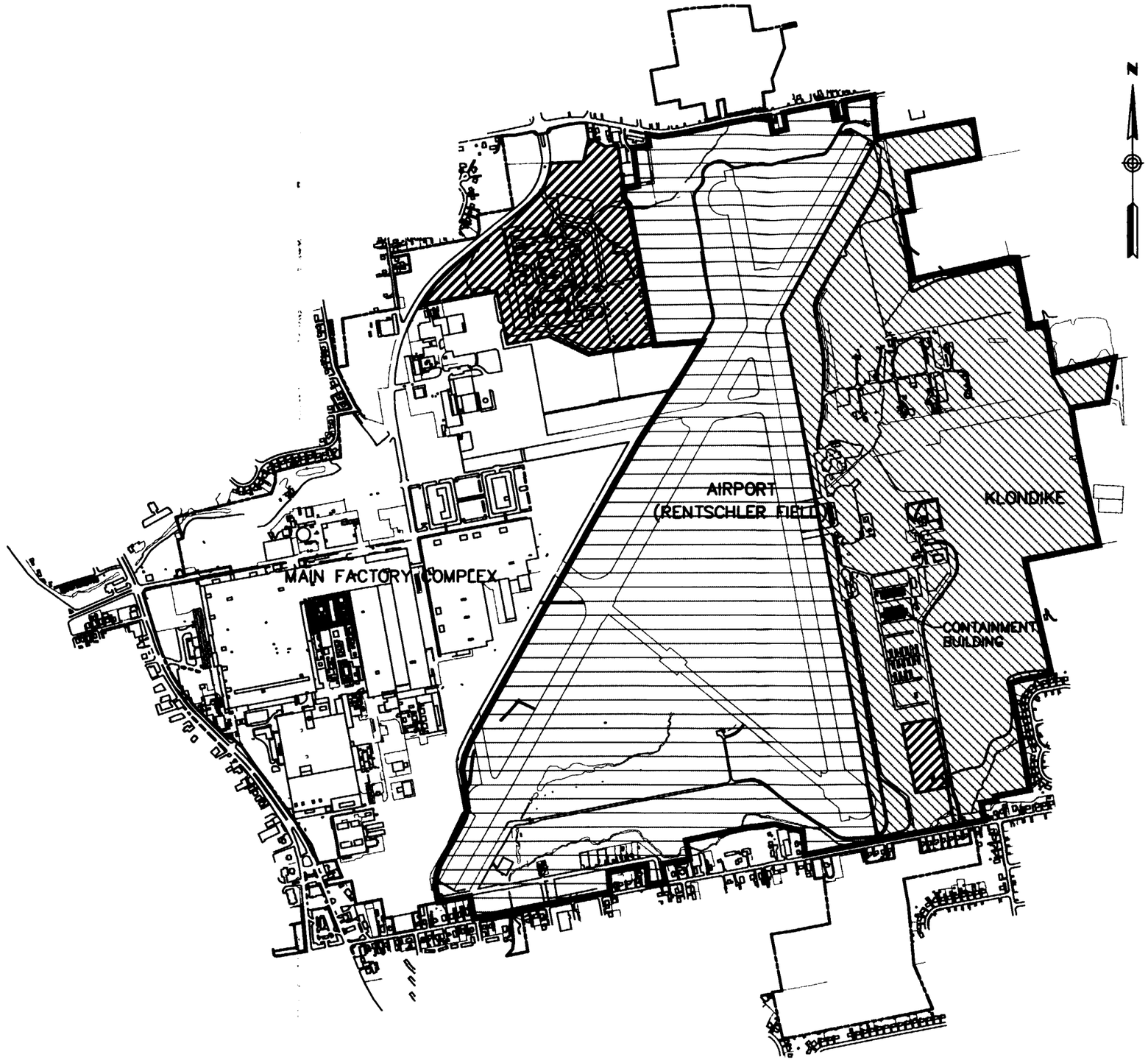
AIRPORT/KLONDIKE AREA
TECHNICAL MEMORANDUM 9

PRATT & WHITNEY MAIN STREET FACILITY
USGS TOPOGRAPHIC MAP

Comm.No.	FIGURE 1	TRC
68V8124		

68V8124-F1



LEGEND

- Property line (Approximate location)
- Area boundary (Approximate location)
- Airport area (Rentschler Field)
- Klondike area
- Areas which are not part of the East Hartford Main Street Facility

MAP REFERENCE:

SURVEY CONTROL BY FUSS & O'NEILL, INC
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DATE OF PHOTOGRAPHY: 3/17/91

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AIRPORT/KLONDIKE AREA
TECHNICAL MEMORMANDUM 9
PRATTT & WHITNEY MAIN STREET FACILITY
SITE PLAN

Comm.No.		
68V8124	FIGURE 2	LEA

68V8124-F2

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DRAWINGS

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DRAWING 1: HABITAT TYPES AND LOCATIONS

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